

Variable definitions

$$a_0 := 0.529177249 \cdot 10^{-10} \cdot \text{m} \quad \text{fm} := 10^{-15} \cdot \text{m} \quad \text{\AA} := 10^{-10} \cdot \text{m}$$

$$c := 299792458 \cdot \frac{\text{m}}{\text{sec}} \quad ce := 1.602176462 \cdot 10^{-19} \cdot \text{coul} \quad \text{ce is abbreviation of absolute value of charge on electron}$$

$$\alpha := 7.297352533 \cdot 10^{-3} \quad \text{eV} := ce \cdot \text{volt} \quad m_e := 9.10938188 \cdot 10^{-31} \cdot \text{kg} \quad m_e \text{ is electron mass}$$

$$h := 6.62606876 \cdot 10^{-34} \cdot \text{joule} \cdot \text{sec} \quad \text{amu} := 1.6605402 \cdot 10^{-27} \cdot \text{kg}$$

$$m_p := 1.6726231 \cdot 10^{-27} \cdot \text{kg} \quad m_p \text{ is proton mass}$$

$$\epsilon := 8.854187817 \cdot 10^{-12} \cdot \frac{\text{farad}}{\text{m}} \quad \mu_0 := 4 \cdot \pi \cdot 10^{-7} \cdot \frac{\text{newton}}{\text{amp}^2} \quad \text{Hz} := \text{sec}^{-1}$$

$$m_e := \frac{m_e \cdot m_p}{m_e + m_p} \quad \text{Reduced electron mass}$$

The principal quantum number "p", used here, is 1/n, where n is the usual principal quantum number

Calculations

$$\lambda = p \cdot 2 \cdot \pi \cdot r \quad \text{Lissajous} \quad (\text{I})$$

$$\lambda = \frac{h}{m_e \cdot v} \quad \text{De Broglie} \quad (\text{II})$$

$$\frac{m_e \cdot v^2}{r} = \frac{ce^2}{4 \cdot \pi \cdot \epsilon \cdot r^2} \quad \text{Force balance} \quad (\text{III})$$

$$p \cdot 2 \cdot \pi \cdot r = \frac{h}{m_e \cdot v} \quad \text{Lissajous + De Broglie} \quad (\text{IV})$$

$$\text{solving for } v \Rightarrow v = \frac{h}{(2 \cdot \pi \cdot r \cdot m_e \cdot p)} \quad (\text{V})$$

Substitution of V in III and solving for r =>

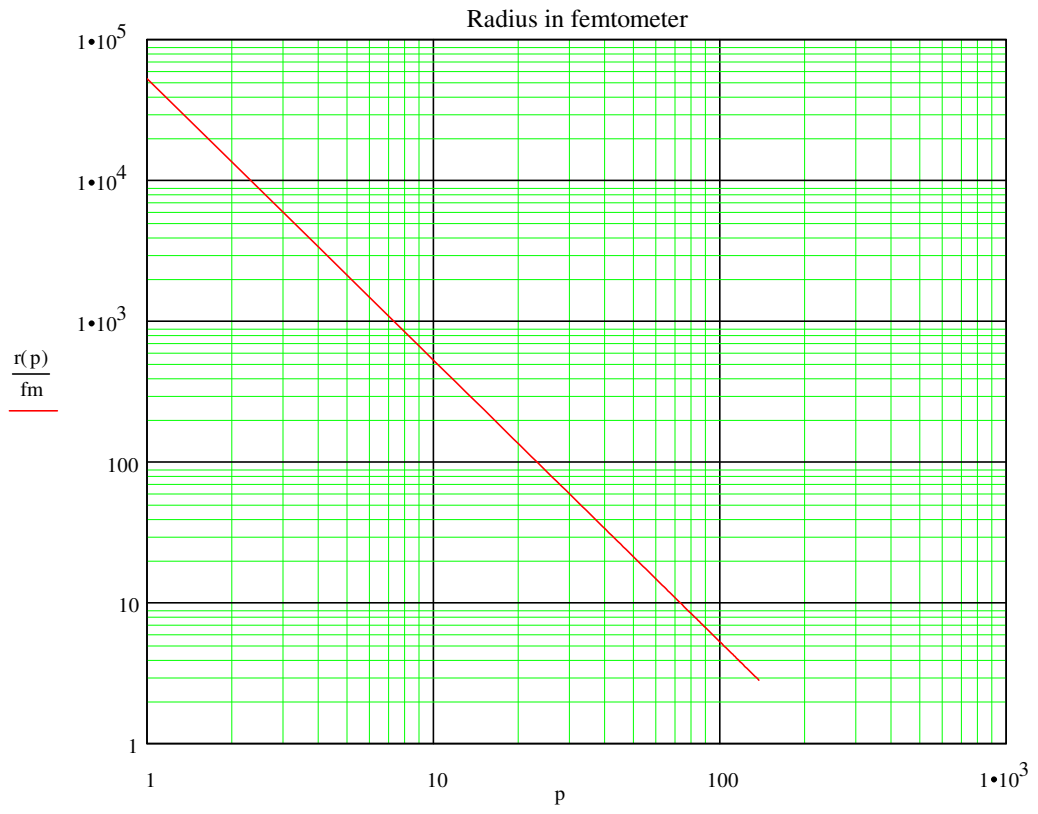
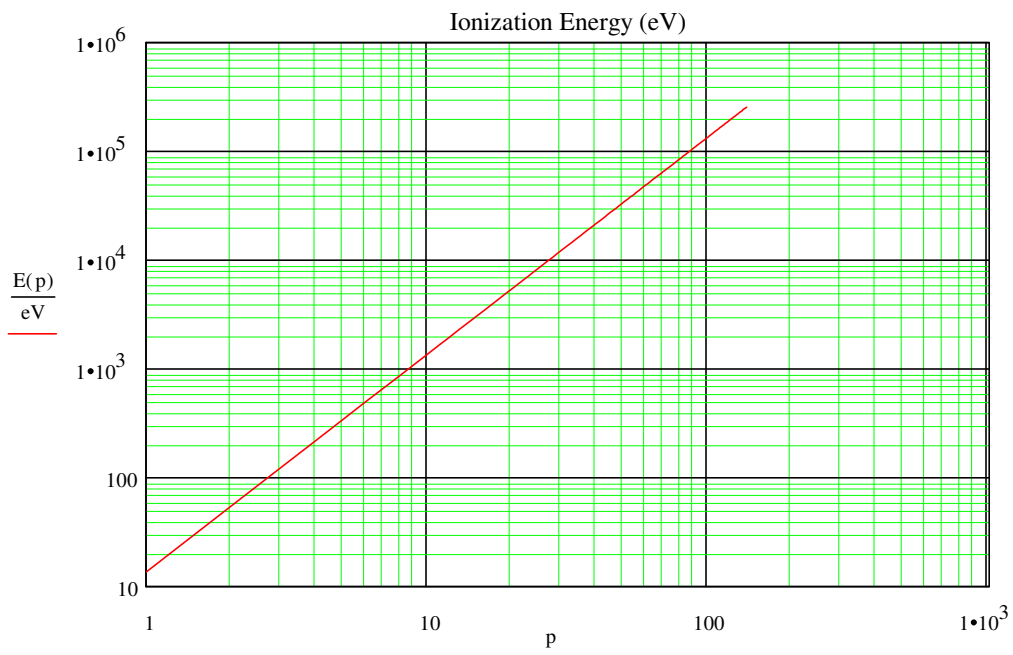
$$r(p) := \frac{h^2 \cdot \epsilon}{m_e \cdot \pi \cdot ce^2 \cdot p^2} \quad \text{This is Bohr radius / } p^2 \quad (\text{VI})$$

$$E = \frac{ce^2}{4 \cdot \pi \cdot \epsilon \cdot r} - \frac{1}{2} \cdot m_e \cdot v^2 \quad \text{ionization energy} \quad (\text{VII})$$

Substitution of V and VI in VII =>

$$E(p) := \frac{1}{8} \cdot \frac{ce^4}{(\epsilon^2 \cdot h^2)} \cdot m_e \cdot p^2 \quad \text{This is } p^2 \text{ x ionization energy of "ground state" Hydrogen} \quad (\text{VIII})$$

The angular momentum for each orbital is simply $\frac{h}{2 \cdot \pi \cdot p}$ $p := 1, 2, \dots, 137$



$$E_{\text{Ionization}_p} := E(p)$$

$$\text{Radius}_p := r(p)$$

Number in shaded column is p

	0	
0	0	
1	13.598	
2	54.393	
3	122.385	
4	217.573	
5	339.957	
6	489.538	
$E_{\text{Ionization}} =$	7 666.316	$\cdot eV$
	8 870.29	
	9 1101.461	
	10 1359.829	
	11 1645.393	
	12 1958.153	
	13 2298.11	
	14 2665.264	
	15 3059.614	

	0	
0	0	
1	0.52947	
2	0.13237	
3	0.05883	
4	0.03309	
5	0.02118	
6	0.01471	
Radius =	7 0.01081	$\cdot \text{\AA}$
	8 0.00827	
	9 0.00654	
	10 0.00529	
	11 0.00438	
	12 0.00368	
	13 0.00313	
	14 0.0027	
	15 0.00235	